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On the Os PUBIS of POLACANTHUS FOXII. By H. G. SEELEY, Esq.,  
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THE evidence of the systematic position of the Wealden fossil *Polacanthus* has not been very precise. Mr. Hulke in 1881 regarded the dermal armour as closely resembling that of *Scelidosaurus*; and the dermal spines were compared with those of *Acanthopholis*, *Stegosaurus*, and *Omosaurus*, with indications of some differences of structure. It is to the Wealden *Hylaeosaurus* that *Polacanthus* was most closely allied, the resemblance in their dermal spines being very close, and their tibiae are stated to be remarkably alike. These views were adopted by Prof. Marsh, who in January 1882 placed *Polacanthus* in the Scelidosauridae, immediately after *Hylaeosaurus*.

When the great tuberculate shield which covers the pelvic region in *Polacanthus* became known in 1887 by the skill of Mr. J. Lingard in fitting it together and of Mr. Richard Hall in removing the matrix, Mr. Hulke described the pelvis,<sup>1</sup> and found the ilia so blended with the dermal bones that their exact form was not made out.<sup>2</sup> The remains of the *os pubis* are said to be too fragmentary to give the shape of that bone; but it was thought that indications were recognizable of its division into posterior and anterior parts. I was unable to recognize any indication of that bone on the shield, and the lettering on Mr. Hulke's figure only refers to the ischium and acetabulum. Further search fortunately resulted in detecting the missing pubis as an isolated specimen, collected by Mr. Fox with the other remains, east of Barnes Chine, in the Isle of Wight, in 1865. It appears to be indicated in Mr. Lydekker's 'Catalogue of Fossil Reptiles in the British Museum,' Pa't I. p. 190, by the description "a dermal scute bearing a short spine." This bone I regard as the anterior portion of the left pubis, the short spine being the proximal portion of the post-pubis; together they prove that the pubis in *Polacanthus*, while showing differences, was constructed substantially upon what may be termed "the Iguanodont plan." The most obvious difference is that the anterior pre-acetabular portion is relatively shorter than in any genus hitherto described.

The thin anterior plate of the pubis, which was vertical and compressed from side to side, thickens as it extends backward to form the superior articular surface for the ilium, the margin of the acetabulum, and the small inferior articulation with the ischium, which was not sutural.

From its inferior internal side is given off the so-called post-

<sup>1</sup> Phil. Trans. Roy. Soc. vol. clxxviii. B, pls. viii., ix.

<sup>2</sup> The outline of the ilium is shown in pl. ix. (*op. cit.*), except that the inner anterior border of the bone is less clearly defined in the drawing than in the specimen.

pubis. It is directed downward and backward, from in front of the acetabulum, from which it is separated by a narrow notch. Only about  $1\frac{1}{2}$  inch of its length is preserved, but this shows it to be a vertically compressed, slightly oblique rib-like process, sub-ovate in section, being about  $1\frac{2}{10}$  inch deep by  $\frac{6}{10}$  inch wide. The notch which divides it from the acetabulum is much narrower than in *Iguanodon*; and the process is not prolonged on to the inner surface of the pre-acetabular part of the bone with the same convexity of surface as in *Iguanodon*, but is flattened in the way shown in fig. 1, facing this page.

The articular surface on the pubis for the ilium is situate at the upper hinder angle of the bone, above the acetabulum, which it meets at about a right angle. It is oblique to the superior contour, being inclined backward; is subtriangular in form, rugose, convex, about 2 inches wide and nearly as deep; it manifestly fitted on to the descending pubic process of the ilium, though, owing to compression of the shield, it does not now make a close union.

The acetabular surface of the pubis is below and behind its iliac articulation. It is oblong,  $3\frac{1}{2}$  inches in length, smoothly concave as it extends downward and backward, is inclined somewhat obliquely outward, and terminates inferiorly in a defined margin, below which is an oblique compressed rounded lip, which presumably connected with the ischium. The lateral acetabular margins are subparallel, the external side being flattened; and the internal side, which extends about 1 inch farther backward, is more concave in the vertical direction. The transverso measurement below the iliac articulation is under 2 inches, whilst inferiorly, towards what I regard as the ischiac surface, it exceeds 1 inch.

The ischiac articulation, when seen from behind, is small and semi-ovate, being convex below; it is oblique, so that its depth is twice as much on the inner as on the outer border. It is convexly rounded, both from side to side, and from the acetabular margin downward. In no other specimen have I seen this surface so well preserved.

The anterior blade of the pubis is directed forward and downward from the acetabulum, and slightly outward. It is relatively short when compared with the pre-acetabular part of the bone in *Iguanodon*, *Camptosaurus*, and allied genera, with which it may be compared on account of the similarity in form and condition of the base of the posterior element of the pubis. It does not show the anterior antero posterior widening seen in *Iguanodon* nor the forward curve at its extremity figured in *Camptosaurus*. It is obviously shorter and relatively deeper than the same element in *Stegosaurus*, which has the post-acetabular part of the bone almost as wide as the pre-acetabular part. This blade is oblong in form, compressed, and becomes thinner as it extends forward. Its length, measured from the external acetabular border, is  $6\frac{1}{4}$  inches; from the hindermost posterior border of the acetabulum the length is  $8\frac{1}{2}$  inches. The depth of the bone is about 5 inches in the articular region, 4 inches in the middle in front of the post-acetabular element, and

## POLACANTHIUS FOXII.

Fig. 1.

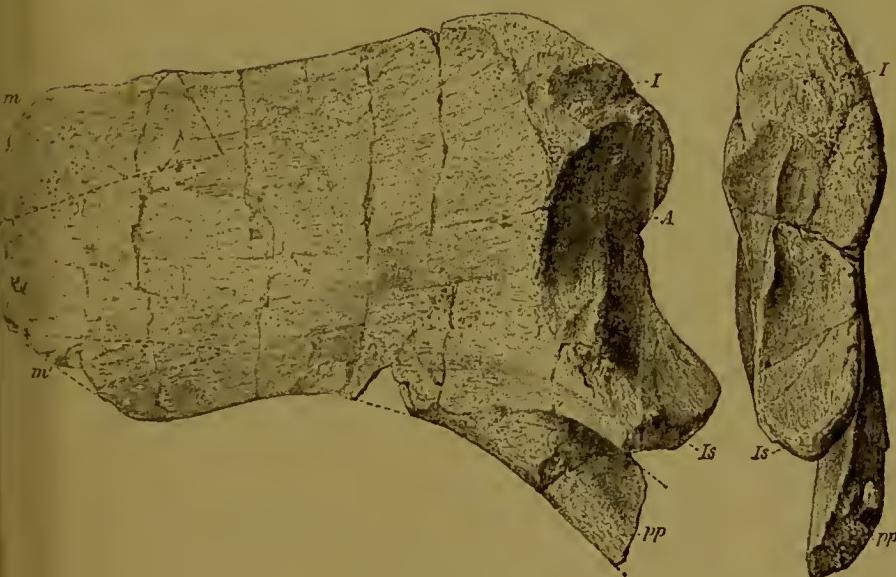


Fig. 2.

## EXPLANATION OF FIGURES.

Right ilium and ischium,  $\frac{1}{5}$  natural size.

To the right in the figure is seen the shield, with the dorsal ribs (*r*) passing under the anterior blade of the ilium; to the left are the 5 sacral ribs (*s*) meeting the acetabular region of the ilium. *P* = position of attachment for the pubis; *A* = acetabulum; *Is* = ischium.

Left pubis: external aspect and posterior aspect.  $\frac{3}{5}$  natural size.

The anterior blade of the bone is directed slightly outwards.

*I* = surface for ilium; *A* = articular surface for the pelvic acetabulum; *Is* = articular surface, presumably for the ischium; *pp* = posterior process of pubis, fractured; *m m'*, on the internal viscerai surface are two V shaped impressed articular surfaces, here indicated by dotted lines.



3 inches deep in front. Its anterior end curves a little outward, as in other genera. The antero-superior margin of the blade is nearly straight, compressed and sharp; the terminal contour is convex. The infero-posterior margin may be slightly broken in front; it is concave in the hinder part of its length, being prolonged continuously on to the post-acetabular process.

An angular impress, ill-defined, is seen on the inner side at the anterior extremity of the pre-acetabular plate, but there is no specimen among the remains of *Polacanthus* which can be identified as being the pre-pubic bone. No pre-pubic bones are known in *Omosaurus*, though it is manifest from the size and width of the pelvis that the pubes could not have met each other.

On the whole, the pubic bone seems to be in many respects intermediate in its characters between *Omosaurus* and *Iguanodon*.

The ischium in its singular curved form is only paralleled by *Triceratops*, which is stated by Baur to be identical with *Agathiaurus*. But in *Polacanthus* the bone is wider, with a curious outward process extending from the acetabulum over the ilium, shown in the figure, and the pubis is dissimilar.

The ilium of *Polacanthus* throughout its extent is blended with the shield, so that the preservation of the shield has apparently resulted from the support of the thin underlying bony framework on which it rests. Possibly the definition of the ilium may have become slightly more evident than when the specimen was first reconstructed; but from the acetabulum a line diverges outward and forward, separating darker thicker tissue external to it from the paler substance of the shield on which the ribs rest. I take the great anterior triangle of darker tint to represent the thin blade of the anterior process of the ilium. It is seen to be superimposed upon four of the ribs which are obscured beneath it; but there is no strong demarcation to separate the bone of the ilium from the shield, and the two are blended, much like the rib and costal plate of a Chelonian. Still its limits are seen. The pre-acetabular process seems to form one half the length of the bone, and to approximate both in shape and outward development to the corresponding part of the ilium of *Omosaurus*. The post-acetabular process was relatively short and truncated; its form is shown in fig. 2. It extends nearly to the posterior margin of the shield, and, owing to removal of scutes, is seen exposed in this position on the dorsal aspect in Mr. Hulke's plate.<sup>1</sup>

The length of the right ilium, which is the more perfect, appears to be 35 inches, but it may have extended a little farther forward.

From this arrangement it results that, while most Ornithischia have the ilia vertical, in *Polacanthus* they are horizontal. The margins, which are usually highest here, are bent outward and downward with the convexity of the shield so as to descend lower than the acetabulum.<sup>2</sup> From this condition the acetabulum has a trans-

<sup>1</sup> Phil. Trans. Roy. Soc. vol. clxxviii, B (1887) pl. xviii.

<sup>2</sup> A similar type of ilium unconnected with a shield is catalogued under *Cetiosaurus* in the British Museum, Cat. Foss. Rept., Part I. p. 143.

verse position vertical above the femur, and is in a way imperforate. It is noticeable that, while the sacral ribs form 5 lateral buttresses to support the acetabular part of the ilium, several pre-sacral ribs (in no way modified) extend between the external armour and the ilium, for the more anterior are seen through the thin pre-acetabular plate of the ilium. And this indicates that armour, ribs, and ilium blended late in life.

There is a very close resemblance in the ilium between *Polacanthus* and *Omosaurus*; for *Omosaurus* has a similar large horizontal acetabulum, while the pre-acetabular plate is of similar form, and extends horizontally forward and outward, and the post-acetabular part is similar. There is also a manifest resemblance in the forms of the sacral ribs, and in their mode of attachment to the sides of the vertebræ to which they belong, although in *Polacanthus* they tend to a slightly more anterior position. In *Omosaurus*, however, external armour on the trunk is unknown.

Other resemblances to *Polacanthus* are found in the Gosau fossil *Crataomus*. When that type was described in 1881 I had not seen any of the remains of this armoured Wealden fossil. But I drew attention to a figure by the late Mr. J. E. Lee<sup>1</sup> from the Wealden of the Isle of Wight, which shows a dermal plate with tubercles upon an osseous base, as similar to armour of *Crataomus*.<sup>2</sup> Mr. Lee's fossil may have belonged to *Polacanthus* or a nearly allied genus. The dorsal vertebrae of these genera are very similar, as is evident on comparing Phil. Trans. Roy. Soc. 1881, pl. lxx., and Quart. Journ. Geol. Soc. vol. xxxvii. pl. xxx. fig. 3. The femur in both corresponds in type and in many details. If there had been any grounds for referring the remarkable plates to *Crataomus*<sup>3</sup> which Bunzel had figured as the ilium of *Danubiosaurus* the resemblance might have been carried further. It has been shown that those remains consist of a rib-like lower part, with which is blended a superimposed thick smooth armour, like that of a Chelonian. Without re-examination it may not be possible to form a definite judgment on these remains, but there seems some likelihood that they may prove to be portions of the ilia of *Crataomus* with confluent smooth armour extending forward from the acetabulum. *Polacanthus*, however, has no such smooth scutes, and all the armour of *Crataomus* which can be compared with it is either tuberculate or rugose with vascular impressions.

Ornithischians with smooth armour, however, existed in the Wealden deposits. And the British Museum acquired in the Beckles Collection a portion of the acetabular region of such a fossil which differs from *Polacanthus* in the far greater thickness of the ilium above the acetabulum, in the forms of the confluent sacral ribs constricted from front to back, and in the absence of all trace of ornament from the smooth and relatively thin dermal shield above the ilium as preserved. The species is larger than

<sup>1</sup> Ann. Mag. Nat. Hist. vol. xi. (1843) pl. i., and 'Note-book of a Naturalist.'

<sup>2</sup> Quart. Journ. Geol. Soc. vol. xxxvii. (1881) pl. xxviii.

<sup>3</sup> *Ibid.* p. 694.

*Polacanthus Foxii*, and shows that the Wealden fauna contained more than one type of heavily-armoured Saurian.

It is not improbable that the dermal bone figured<sup>1</sup> from Gosau, which was referred to *Cratæomus*, and compared in form to the horn core of an ox, may be the horn upon the frontal bone. If so, it establishes a striking difference between that genus and *Struthiosaurus*, which has a small skull, without anything to indicate supraorbital horns such as have been suggested for *Cratæomus*. Cope has compared it to *Monoclonius* or the horn of *Agathaumas*,<sup>2</sup> and Marsh to the horn of *Triceratops*.<sup>3</sup> On this comparison Zittel<sup>4</sup> has placed *Cratæomus* in the suggested sub-order Ceratopsia. The bone may possibly be a link of alliance between *Agathaumas* and *Cratæomus*. But I do not discover evidence of stronger affinity between those genera than is manifest between *Cratæomus* and *Polacanthus*, or between *Polacanthus* and *Omosaurus*. So that I am led to associate all those genera in near alliance, in the Scelidosaurian division of the order Ornithischia.

[Note.—The pubis of *Polacanthus* has been freed from the matrix by Mr. Richard Hall, since this paper was read.—December 31, 1891.]

<sup>1</sup> *Op. cit.* pl. xxviii. fig. 4.

<sup>2</sup> E. D. Cope suggested this identification to me in 1886.

<sup>3</sup> Geol. Mag. for 1889, p. 207; *ibid.* for 1891, p. 193.

<sup>4</sup> 'Handb. der Palæontol.' Band iii. Abth. i. p. 753.

